PELOMYXA CAROLINENSIS (WILSON) OR CHAOS CHAOS (LINNAEUS)?[1]

NOLAN E. RICE

Carolina Biological Supply Company, Elon College, North Carolina

Introduction

Considerable confusion exists concerning the name of the large amoeboid organism which was discovered and named *Pelomyxa carolinensis* by Wilson in 1900. The other name by which this organism is known is *Chaos chaos* (Linnaeus). It is the purpose of this paper to show that the valid scientific name is *Pelomyxa carolinensis* Wilson.

Historical

The historical data have been presented in full elsewhere (Schaeffer, 1926; Mast and Johnson, 1931) but for clarity of discussion it is necessary to list the pertinent facts.

1. In 1755 Roesel von Rosenhof found an amoeboid organism which he described, figured, and named "der kleine Proteus."

2. In 1758 Linnaeus named Roesel's organism *Volvox chaos* and in 1767 *Chaos chaos* because the name Volvox had been used earlier for the colonial flagellate which today bears that name.

3. In 1900 Wilson discovered a large amoeboid rhizopod in North Carolina which he described and named *Pelomyxa carolinensis*.

4. This organism was again found by Penard in France (1902); Kepner and Edwards, in Virginia (1917); Schaeffer, in Tennessee and New Jersey (1937); and Brandwein, Penn, and Shiel, in New York (1943). It is now being maintained in clone cultures by Schaeffer, Belda, Pace,[2] Rice, and perhaps others.

5. Schaeffer (1926) maintains that Roesel's "der kleine Proteus" and Wilson's *Pelomyxa carolinensis* are identical generically and specifically, and that the valid scientific name is therefore *Chaos chaos* (Linnaeus). Stiles (1905), however, believes that the name *Chaos chaos* (Linnaeus) is the valid name for *Amoeba proteus* Leidy, maintaining that Roesel's "kleine Proteus" is like this common laboratory amoeba.

6. Mast and Johnson (1931) present evidence which shows that Roesel's organism "is neither generically nor specifically like either Leidy's proteus or Wilson's carolinensis." They contend that it is a myxomycete, "an organism usually classified as a plant."

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[2] Dr. D. M. Pace, College of Pharmacy, University of Nebraska, kindly furnished the pelomyxae from which the author's clone was established.

Facts and Discussion

1. *It is impossible to ascertain the exact structure of Roesel's "der kleine Proteus."* A careful study of Roesel's figures reveals that these are barely more than outlines containing a mass of dots and circles. One could not by any stretch of the imagination consider these figures sufficient basis for the identification of any amoeboid species. What the dots and circles represent is obscure. Schaeffer (1938) states that Roesel knew nothing about nuclei, contractile vacuoles, crystals, etc., since these had not yet been discovered, nevertheless Schaeffer admits that these structures are quite important for identification.

Stiles (1905) believes Roesel's organism is *A. proteus* (Leidy), its valid name being *Chaos diffluens* (Müller); Schaeffer (1926, 1937, 1938) maintains that it is *P. carolinensis* (W.), its valid name being *Chaos chaos* (L.); and Mast and Johnson (1931) contend that it is neither, finding it to be a myxomycete. This difference of opinion is in itself strong support for the contention that reasonable proof of the identity of this organism cannot be found.

The first description of *P. carolinensis* by which it can be identified was published by Wilson (1900). Schaeffer (1926, 1937) states that the organism he found in Tennessee, and the one he found in New Jersey (1937) and now maintains in clone culture, is identical with *P. carolinensis* (W.) and "der kleine Proteus," holding that it should be called *C. chaos* (L.). However, since it is impossible to ascertain the identity of "der kleine Proteus," the priority rule establishes *Pelomyxa carolinensis* Wilson as the valid scientific name.

2. *A comparison of the characters of P. carolinensis* (W.) *and A. proteus* (L.) *shows that they are generically distinct.*

Schaeffer (1926, 1937) maintains that *A. proteus* (L.) and *P. carolinensis* (W.) are morphologically quite similar, placing them in the genus Chaos. On the basis of serological tests he (1937) suggests that they may be "one and the same species." But he (1916) also finds that *A. proteus* (L.) comprises three distinct species (proteus, discoides, and dubia) which he (1926) later advances to the rank of genera (Chaos, Metachaos, and Polychaos).

This raises two questions. Is there any evidence to show that *A. proteus* (L.) and *P. carolinensis* (W.) are generically identical? Does the evidence justify the creation of three new genera out of the species proteus? The second question has been considered elsewhere (Mast and Johnson, 1931). An answer to the first may be found by comparing the chief characters of the two organisms. Reference to Figure 1, a photomicrograph of the organisms in the same microscopic field, clearly shows a great difference in size. Other differences are not so apparent. These are brought out in Table 1 which summarizes pertinent data from various investigators. Most of the measurements credited to them have been checked by the author without serious disagreement. Nevertheless, it must be borne in mind that all measurements represent averages of numerous determinations on diverse clones.

It will be noted that the two organisms are similar in several respects. Both accomplish locomotion by indeterminate lobopodia and possess bipyramidal crystals, Glanzkörper, and small non-refractile granules. The crystals and Glanzkörper, however, are somewhat larger in *P. carolinensis* (W.) than in *A. proteus* (L.). The table also shows that these organisms differ markedly in size (as

TABLE I

Summarized comparison of Amoeba and Pelomyxa

Character	*Amoeba proteus* (Leidy)	*Pelomyxa carolinensis* (Wilson)
Length	Up to 600 μ (Kudo)	1,500–3,000 μ (Wilson); up to 5,000 μ (Schaeffer)
Diameter	134 μ (Chalkley)	500 μ (Schaeffer)
Volume	0.0024 c. mm. (Chalkley)	0.12–1.20 c. mm. (50 to 500 $\times$ 0.0024) (Schaeffer)
Pseudopodia	Locomotion by indeterminate lobopodia	Locomotion by indeterminate lobopodia
Locomotion	Comparatively active; recovers from disturbance quickly	Sluggish; recovers from disturbance slowly
Crystals	Truncate bipyramidal; up to 4.5 μ long (Schaeffer); 1.5 $\times$ 2.0 μ (Rice)	Truncate bipyramidal; 1.5 $\times$ 2.8 μ; up to 10 μ (Rice)
Glanzkörper	Up to 4 μ (Rice)	Up to 10 μ (Rice)
Smaller granules	About 0.7 μ (Rice)	About 0.8 μ (Rice)
Contractile vacuoles	Typically one at posterior end; systole rapid; new vacuole usually formed at same place; character of permanent organelle (Adolph; Metcalf; Mast); 20–50 μ; av. 35 μ (Rice)	Usually between 5 and 15; as many as 25 or 30; temporary organelle (Belda); systole slow; some gradually disappear (Rice); 30–70 μ; av. 36 μ (Rice)
Nuclei	Typically uninucleate; discoidal; nucleus and granules easily visible in living specimen; av. dimensions 36 $\times$ 26 $\times$ 18 μ (Rice)	Typically between 300 and 400 nuclei; up to 1,000 (Schaeffer); ovoidal or discoidal (two strains; Schaeffer); nucleus and granules not easily seen. 16–18 μ (Wilson); 20 $\times$ 15 μ (Rice)
Food vacuoles	Variable in size and number; several dozen	Variable in size and number; up to 100
Reproduction	Binary fission; nuclear division mitotic	Tripartite division of mother cell following simultaneous mitotic division of nuclei (Schaeffer)

measured by length, diameter, or volume), number and average size of the nuclei, number and character of the contractile vacuoles, and type of reproduction.

These differences are largely those which led Greeff (1874) to establish the genus Pelomyxa. He specifically states that the large number of nuclei forms the principal character of the genus. A comparison of the original descriptions of *P. palustris* Greeff (1874), *P. villosa* Leidy (1879), *P. greeffi* Blochmann (1893), and *P. carolinensis* (W.) shows that they are large, sluggish, naked rhizopods containing numerous nuclei, many vacuoles, and large Glanzkörper.

The genus Pelomyxa, therefore, includes rhizopods with a multinuclear organization, whereas the genus Amoeba, for the most part, those with a uninuclear

organization. Greeff (1874), Leidy (1879), Blochmann (1893), and Wilson (1900) recognize this multinuclear organization as sufficient basis on which to establish the genus Pelomyxa. In their contention that *P. carolinensis* (W.) is the valid scientific name for Wilson's organism Mast and Johnson (1931) appar-

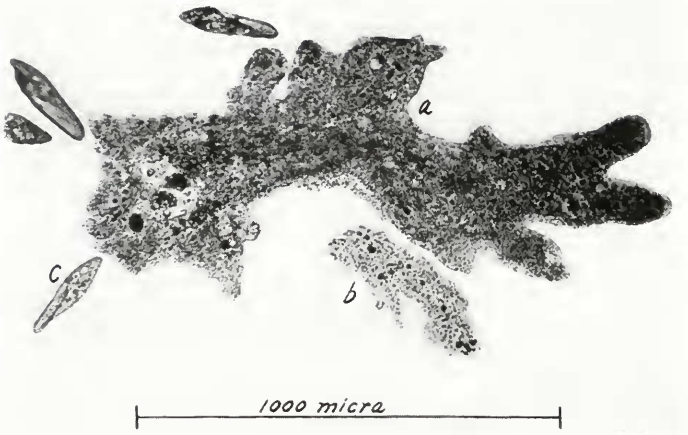

FIGURE 1. Photomicrograph of *Amoeba proteus* (L.) and *Pelomyxa carolinensis* (W.) in the same field. *a*. Pelomyxa; *b*. Amoeba; *c*. Paramecium multimicronucleatum P. et M. (Photograph by Mr. T. H. Mackintosh.)

ently agree with them. Schaeffer (1926, 1937, 1938) evidently does not accept this point of view.

The evidence presented here shows that *A. proteus* (L.) and *P. carolinensis* (W.) are generically distinct, and that it is illogical, therefore, to place them in the same genus (Chaos).

SUMMARY

1. Since it is impossible to ascertain the exact structure of Roesel's "der kleine Proteus" from his description and figures, it is impossible to identify this organism.

2. *P. carolinensis* (W.) and *A. proteus* (L.) differ in characters of such importance that they must be considered members of different genera.

3. The valid scientific name of Wilson's organism is *Pelomyxa carolinensis* Wilson because he discovered, accurately described, and properly named it.

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